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Analysis of Relationship between China's Energy Investment and Financing and the Development of Energy Industry

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Abstract

In recent years, China's energy consumption growth led to a sharp increase in the investment and financing scale of energy industry, and it aroused wide concern how the scale growth and structure change of energy industry investment and financing affects the development of energy industry. This article examines the impact of energy industry investment structure on the energy industry development by using time series data from 2003 to 2009, and analyses the effect of energy industry financing structure on its development by using time series data from 2004 to 2009.The results show that the growth of energy industry investment scale can improve the energy industry scale growth, but the effect for increasing its profitability is not significant ,which indicates that investment efficiency is not obvious. And the effect of different financing structure on output growth and profit contribution is significant. As a result, the investment efficiency and financing structure of energy industry needs to be improved.

Keywords: Energy Finance; Energy Investment and Financing; Development of Energy Industry; Panel Data

1. Introduction

In the 21st century, as the rapid economic development in China results in a increase of energy demands, energy industry investment is showing a rapid growth as well as its financing demand, and the financing structure is also undergoing significant changes. The table1 shows the investment growth of China's energy industry. With the restricting factors including China's financial market, energy industry

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system and others, the financing structure of coal industry investment demand mainly depends on enterprise self-financing, and budgeted funds, foreign investment and bank credit tends to decrease, as shown in Table 2.

Table1 The comparison on investment of energy industry with total fixed asset investment from 2003 to 2009 ，Unit：hundred million yuan, %

Period	Oil and gas investment value	year-on-year growth	Coal industry investment value	year-on-year growth	Electric-heat production and supply investment value	year-on-year growth	Social fixed-assets investment	year-on-year growth
2003	946		436.4				55566.6	
2004	1112.3	17.58	690.4	58.20	4854.41	45.5	70477.43	26.83
2005	1463.6	31.58	1162.9	68.44	6503.20	34.0	88773.613	25.96
2006	1822.2	24.50	1459.0	25.46	7274.27	11.9	109998.16	23.91
2007	2225.5	22.13	1804.6	23.69	7906.52	8.7	137323.94	24.84
2008	2675.1	20.20	2399.2	32.95	9023.66	14.1	172828.4	25.85
2009	2791.5	4.35	3056.9	27.41	11139.07	23.4	224598.77	29.95

Data Source: National Bureau of Statistics

Table 2 The percentage component of fund sources of coal producing and selection, oil and gas industry and electric power industry investment from 2004 to 2009，Unit: %

Industry	Period	State budget fund	Domestic loan	Foreign capital	Self financing	Other capital
Coal producing and selection industry	2004	2.13	19.31	0.21	73.54	4.81
	2005	1.34	16.34	0.007	77.26	5.053
	2006	1.46	13.83	0.4	81.6	2.71
	2007	1.3	11.52	1.15	82.64	3.39
	2008	1.04	10.48	0.36	83.52	4.7
	2009	1.44	11.75	0.21	83.06	3.54
Oil and gas industry	2004	1.34	13.6	1.45	74.71	8.89
	2005	0.21	14.5	2.24	71.53	11.52
	2006	0.44	13.02	3.27	75.56	7.71
	2007	0.87	13.59	2.15	75.85	7.54
	2008	1.17	13.76	3.17	75.8	6.1
	2009	0.92	13.15	2.04	78.44	5.45
Electric power industry	2004	3.8	44.5	3.6	48.1	
	2005	4	46.1	2.1	47.8	
	2006	4.3	46.5	1.1	48.1	
	2007	6	43.6	1	49.4	
	2008	5. 70	41.5	0.8	52	
	2009	6.5	38.5	0.6	54.3	

Data Source: National Bureau of Statistics

However, in the context of rapid growth of China's energy investment financing scale, the efficiency of energy investment and financing is facing severe challenges. According to the “International Energy Outlook 2009”, it shows that China’s energy consumption intensity was 2.8 and 4.4 times over America and Japan, while energy utilization efficiency was significantly lower than developed countries. So this paper is aimed to obtain accurate evaluation of China's energy industry investment and financing effects. Will investment growth increase the scale and profit of energy industry? What kind of financing structure can best promote energy financing efficiency? The solution of these issues is important for improving the capital utilization efficiency in energy industry and ensuring the energy financial security. Moreover, it is particularly important for promoting efficiency of energy industry obtaining financial support.

2. Review of research on the relationship between China's Energy Investment and Financing and the Development of Energy Industry

The research of relationship between energy investment and financing and energy industry development belongs to energy finance. The current research of energy financial security warning management has just started, so there's no exact definition of energy finance in academia. With the financial system, the energy finance is based on "energy", and eventually serves the energy industry proposed by literature 1[1] . And literature 2 indicates that energy finance can be analyzed from two aspects: virtual energy finance and entity energy finance [2]. But the international scholars more concern about the path of energy industry development supported by finance field. The literature 3 studies the energy service companies, and indicates that the biggest obstacles for developing countries to improve energy efficiency are a lack of appropriate financing institutions, because they are facing many problems such as market, financial institution, financing channels, high transaction costs, and inadequate energy pricing policies[3] . Literature 4 proceeds from the EU practice, and proposes the use of EU structural funds to support the new EU members for sustainable development of energy industry[4]. Literature 5 points out that financing issues for improving energy efficiency is not only effective in promoting companies' long-term growth, but also greatly reduces the negative impact on the ecological environment[5]. Literature 6 based on many listed companies from China's coal production and selection, oil and gas production industry, power-steam production and supply, oil processing and cooking industry and gas production and supply industry. It points out the expansion of financing scale can promote output growth, and the contribution rate and energy consumption of different financing structure for output growth is significantly different, but the openness and use efficiency of financing continuously reduce[6] . Literature 7 indicates how to achieve financial support and guide the development of energy industry is the focus of China's energy financial integration[7]. Literature 8 indicates the expansion of comprehensive financing scale help to promote output growth, but the output efficiency is significantly different affected by different financing ways, as well as different financing projects[8] .

From the limited literatures, it can be seen the current research on energy finance issues is still far from forming system, especially based on the whole energy industry data. So the current research represents less significance.

3. Method description of research on the relationship between China's Energy Investment and Financing and the Development of Energy Industry

3.1. Model design

The paper bases on China's coal production and selection, electric production industry, and oil and gas production industry as sample. When analyzing the relationship between financing and investment structure of energy industry and security warning, due to the constraints of relevant statistical data, this paper examines the impact of energy industry investment structure on the energy industry development by using time series data from 2003 to 2009, and analyses the effect of energy industry financing structure on its development by using time series data from 2004 to 2009. The data source is from China's National Bureau of Statistics, research reports proposed by Beijing BCT Investment Consulting Co., Ltd., CEInet database, CCER economic and financial research database from Peking University's China Center for Economic Research and Guotaian database. The model is as follows:

$$Y_{i,t} = c + \alpha X_{i,t} + \beta Z_{i,t} + \xi_{i,t} \quad (1)$$

$Y_{i,t}$ represent safety indicators of energy industry, $X_{i,t}$ represent investment and financing indicators of energy industry, and $Z_{i,t}$ represent control variables.

3.2. Variable declaration

(1) Indicators of energy industry development: In order to fully illustrate the impact of financing and investment structure on energy safety, this paper selects ROA, ROE, output growth rate and sales income growth rate.

(2) Investment structure and control indicators: This paper selects R&D input, fixed assets investment and growth rate of fixed assets investment as independent variables for observing investment. And it selects GDP growth rate, CPI fixed-based data, financial ratio, loan interest rate and monetary supply growth rate as control variables, and CPI fixed-based data sets 2003 as the base period for processing. With R&D input and fixed assets investment, the three indicators are processed by natural logarithm.

(3) Financing structure and control indicators: This paper selects state budget fund, domestic loan, foreign capital and self financing as independent variables for observing financing. State budget fund mainly refers to budgetary funds in central government. Domestic loan mainly measures domestic financial institutions credit for energy companies. Foreign capital includes foreign loan, foreign direct investment and other foreign investment. And self financing refers to raising funds from issuing shares or bonds. In order to fully illustrate the consistency of financing ways trends with maintaining data model, this paper selects the proportions of central finance budget, domestic loan, foreign capital and self financing as independent variables. Ex-factory price index, GDP growth rate and R&D input are selected as control variables, and ex-factory price index and R&D input are taken by natural logarithm.

3.3. Description of measurement methods

According to the theory of panel data, from the perspective of individual members, the general expression of equation model including N-dimensional individual members is as follows:

$$y_{i,t} = a + x_{i,t}b + u_{i,t} \quad (i = 1, 2, \cdots\cdots, N; t = 1, 2, \cdots\cdots, T) \tag{2}$$

$y_{i,t}$ represent vector of $N \times 1$ -dimensional dependent variables, $x_{i,t}$ represent block diagonal matrix of $N \times NK$ -dimensional independent variables; a represent intercept constant vector of $N \times 1$ dimensions，and represent coefficient vector of dimensions, both values are impacted by different individuals; represent disturbance vector of dimensions. It meets the assumption of classical econometric model, including the mean is 0 and the variance is .

According to the F test and Hausman test results of sample data, this paper selects fixed-effect panel data model to analyze samples' individual difference. This meets the fact there is a big difference among financing scale, structure and energy utilization efficiency in different energy sub-sectors. Then this paper also selects FGLS to estimate for eliminating period heteroscedasticity and contemporaneous correlation generated by random error term. And the conversion weight is cross-section SUR.

4. Measurement results and interpretation of research on the relationship between China's Energy Investment and Financing and the Development of Energy Industry

Table 3 studies the relationship between investment structure and safety indicators in energy industry. Estimate results show that the regression coefficient of R&D input is negative with ROA and ROE, but positive with output growth rate and sales income growth rate. This indicates that R&D input can not improve the profitability of companies, but is helpful to improve output value and sales income. The regression coefficient of fixed assets investment and growth rate of fixed assets investment with ROA and ROE is significantly negative. This indicates that the increase of fixed assets investment reduces companies' profitability, while not significantly improves the companies' value and sales income. And

the correlation of GDP growth rate, CPI fixed-based data, exchange rate volatility, financial ratio, loan interest rate and monetary supply growth rate with energy industry safety indicators is not significant.

Table 3 The regression results of investment panel data and development of the energy sector

		ROA	ROE	Output growth rate	Sales income growth rate
Investment structure	R&D input	-0.0943	-0.0804	0.2041	0.1530
	Fixed assets investment	-0.3393**	-0.3585**	0.1867	0.0838
	Growth rate of fixed assets investment	-0.5752*	-0.5141*	0.6189	0.2985
Control variable	GDP growth rate	4.2826	4.9291	0.3365	-2.3233
	CPI fixed-based	2.8214	2.9627	-1.3650	-0.1454
	Exchange rate volatility	0.9470	1.0467	1.3301	-0.3594
	Financial ratio	-0.8760	-0.9650	4.0571	0.3752
	Loan interest rate	-45.7574	-47.7373	-37.7059	15.4089
	Monetary supply growth rate	-1.8969	-1.7354	-2.7938	-1.9260

Note；***,**,* respectively indicates significant under 1%， 5% and 10% confidence level

Table 4 studies the relationship between financing structure and safety indicators in energy industry. Estimate results show that the regression coefficient of state budget fund is non-significantly positive with profitability indicators, while non-significantly negative with output growth rate and sales income growth rate. And domestic loan significantly reduces ROE, but non-significantly for ROE. Meanwhile, it non-significantly improves output growth rate, while reduces sales income growth rate. Foreign capital can improve companies' profitability in higher significant level, and reduce its output growth rate and sales income growth rate. Moreover, the regression coefficient of self financing with energy industry safety indicators is non-significantly negative. The ex-factory price index is positive with energy industry safety indicators, and significantly improves its ROE. Lastly, the regression coefficient of GDP growth rate and R&D input with energy industry safety indicators is non-significant.

Table 4 The regression results of financing panel data and development of the energy sector

		ROE	ROA	Output growth rate	Sales income growth rate
Financing structure	State budget fund	0.4717	2.9737	-22.2602	-7.4502
	Domestic loan	-3.0842**	-2.2235	0.7340	-1.5099
	Foreign capital	7.2487**	8.0947***	-13.1877	-7.0938*
	Self financing	-2.0104	-0.8763	-2.1996	-1.8868
Control variable	Ex-factory price index	1.1070*	0.6785	1.4128	1.4133
	GDP growth rate	0.5934	0.4496	-2.6203	-3.1750
	R&D input	-0.0308	-0.2040	-0.0620	-0.1492

Note；***,**,* respectively indicates significant under 1%， 5% and 10% confidence level

From the above analysis, we can see that in recent years the fast growth of fixed assets investment can not significantly improve the profitability of scale development in energy industry, even for companies' profitability. However, the effect of R&D input is more than fixed assets investment. And the effect of foreign capital and central finance budget is better than self financing and bank credit in financing structure.

5. Policy recommendations

(1) Energy industry must control the scale of fixed assets investment to avoid overcapacity.

National Energy Commission should take up the task of forecasting future energy demand, arranging for duties of energy projects' pace, and regulate the fixed assets investment of energy industry together

with the State Development and Reform Commission. From the development trend of China's economic transformation, its economic growth characterized by high energy consumption will inevitably unsustainable, and the recently sharp increase trend of energy demand can not last forever. Therefore, the adding energy supply, which is produced by those new projects because of energy demand soaring in recent years, is likely to form overcapacity. The state must study the national energy supply, data of demand change and existing energy production capacity. Moreover, for the recent energy production projects including coal, electricity and other energy, the state also should do more detailed analysis of production match, and improve exploration efforts to increase energy reserves so that it can find out the domestic energy resources. Meanwhile, the state should fully consider the capacity reasonability in all processes including the issuance of mining permits.

(2) Adjust the investment structure of energy industry and increase the intensity of R&D input.

Energy industry must increase funding input for research and development and avoid lower redundant construction. And it should increase investment in the utilization of clean energy and the efficient use of traditional energy sources. Then the improvement of technological content and technical level in energy industry is essential. And it also should improve the utilization efficiency of energy investment and financing.

(3) Accelerate the building of energy financial markets, and promote coordinated development of energy finance and environmental finance.

The building of Energy financial market is the major carrier to improve the efficiency of energy investment and financing. Only the sound energy financial market system is possible to adjust the investment and financing structure for energy industry, and provide support for the formation of hard constraints of investment and financing responsibilities. It can integrate spot, forward, futures, options and other financial products, including oil, coal, electricity and many other varieties, to create a multi-level system of energy trading market and trading varieties. Then it can create a multi-channel system of different energy financial institutions, which include energy bank, energy investment fund and energy trust. Besides, forming a variety of multi-way energy funds is useful. Finally, it can use many ways including shareholders' investment, venture capital investment, bank loans, bonds, commercial credit, leasing, trust and other kinds of funds to increase energy development funds.

(4) Optimize the financing structure of energy industry, and improve the utilization efficiency of fund.

Energy industry should increase the proportion of foreign financing appropriately. On the basis of ensuring national energy security，it can be further opening the domestic energy market, and encouraging to introduce more foreign financial institutions for the development of domestic energy market. And it should also strengthen international cooperation and exchanges in the field of energy efficient and clean utilization, as well as in the application sector of new technology achievements.

Secondly, the state budget fund has a higher role in promoting energy development. So the increase of government-led investment in energy safety field related to the lifeline of the national economic security is a very important state policy. Besides, the investment direction of central finance budget should play a major role in guiding and pointing, and promote science and technology progress in energy field. It also plays an important role in energy R&D input, as well as the start-up capital for the promotion of new energy technologies into practical productive forces.

Thirdly, the investing direction of bank credit funds for the coal and electricity production industry must be careful. The various financial institutions should try to cultivate more energy financial professionals, establish and improve the long effective mechanism of monitoring credit for energy projects, risk control and financial guidance.

Fourthly, from the self financing of energy companies, the priority is to improve utilization efficiency of self-financing. The new launched energy projects from energy companies must be careful to avoid blind operation. It may have some short term benefits. But as the crisis of industry overcapacity and the

changes of economic restructuring for energy demand, the capacity of energy companies may face double whammy of market demand-supply changes and industrial restructuring, and thus to cause a greater damage to energy investment. Otherwise, the operation of energy investment projects should also strengthen management to avoid operation risk.

References

[1] LIU Chuan-zhe, HE Ling-yun, Wang Yan-li, HE Li-na. Energy Finance: Connotation and Research Issues [J]. Journal of China University of Mining & Technology (Social Science), 2008(9):59-62.

[2] LI Yu-xin, LI Jing. Researches on the impact of energy finance in the development of oil industry [J]. Friends of Accounting, 2011(3):27-28.

[3] J.P.Painuly, H.Parket al. Promoting energy efficiency financing and ESCO in developing countries: mechanisms and barriers [J]. Journal of Cleaner Production, 2003, 11(6).

[4] Dalia Streimikiene,Valentinas Klevas, Jolanta Bubeliene. Use of EU structural funds for sustainable energy development in new EU member states [J]. Renewable and Sustainable Energy Reviews, 2007,11(6).

[5] Cantore, N. Financing Energy Efficiency - Good for Environment and Good for Development Opinion [J]. December, 2009.

[6] Huang He, Zhang Jian-hua. Energy Industry Development and Financial Support: A Panel Data Analysis [J]. Journal of Guangdong University of Finance, Vol. 2 5 , No. 4，2010（7），89-99

[7] ZHAGN Mo-nan. Timely development of national energy the financial strategy [N]. Shanghai Business , 2009 - 04 - 21.

[8] Christa N. Brunnschweiler. Financing the Alternative: Renewable Energy in Developing and Transition countries, Center of Economic Research (CER-ETH)[J]. ETH Zurich Economics working paper series, No. 06 /49, 2006.